

IN THE CLAIMS

1. (currently amended) A transmission bandwidth control device for controlling a transmission route for a flow in a network, comprising:

a statistical information collecting unit for collecting pieces of statistical information from respective routers connected to the network;

a network information database for storing the statistical information collected;

a user request processing unit for accepting and processing a flow forwarding request from a user terminal;

a route control unit for searching for a route corresponding to the request from the user terminal by referring to the network information database;

a load sharing control unit for executing such a load sharing process as to generate router setting information for sharing a transmission load of the network by referring to the network information database; and

a router control unit for setting a router based on the route information determined by the route control unit and on the router setting information generated by the load sharing control unit,

wherein the route control unit includes a quality guaranteed route searching module searching for quality guaranteed route information corresponding to the flow forwarding request for the forwarding quality guaranteed flow by referring to link statistical information concerning links between the respective routers from the network information database and a quality non-guaranteed route searching module searching for quality non-guaranteed route information corresponding to the flow forwarding request for the forwarding quality non-guaranteed flow, by referring to link statistical information concerning links between the respective routers from the network information database, the load sharing control unit executes the load sharing process by referring to the quality guaranteed route information and

the quality non-guaranteed route information, and the router control unit sets the quality guaranteed route and the quality non-guaranteed route in accordance with the searched quality guaranteed route information and quality non-guaranteed route information.

2. (canceled)

3. (currently amended) A transmission bandwidth control device according to Claim [[2]]1, further comprising a load judging unit for judging whether or not a load state of a path is equal to or smaller than the threshold value by referring to the link statistical information, when the load state of the path is equal to or smaller than the threshold value, the quality guaranteed route searching ~~means~~module searches for the quality guaranteed route information, the load sharing control unit executes the load sharing process by referring to the quality guaranteed route information, and the router control unit sets the quality guaranteed route in accordance with the quality guaranteed route information.

4. (original) A transmission bandwidth control device according to Claim 1, wherein the load sharing control unit executes the load sharing process at an interval of a predetermined period.

5. (currently amended) A transmission bandwidth control device according to Claim [[2]]1, wherein the quality guaranteed route searching ~~means~~module searches for a single piece of route information that meets a requested quality as the quality guaranteed route, the quality non-guaranteed route searching ~~means~~module searches for plural pieces of route information as the quality non-guaranteed routes, and the router control unit sets a plurality of

routes related to the quality non-guaranteed routes in accordance with the plural pieces of route information.

6. **(currently amended)** A transmission bandwidth control device according to Claim [[2]]1, wherein the quality non-guaranteed route searching ~~means~~module searches for a single piece of route information as the quality non-guaranteed route, the quality guaranteed route searching ~~means~~module searches for plural pieces of route information as the quality guaranteed routes, and the router control unit sets a plurality of routes related to the quality guaranteed routes in accordance with the plural pieces of route information.

7. **(currently amended)** A transmission bandwidth control device according to Claim 5, wherein the quality guaranteed route searching ~~means~~module selects such a route as to minimize a ~~cross-over~~ hop count in the network, and the quality non-guaranteed route searching ~~means~~module selects such a route as to minimize the ~~network cross-over~~ hop count.

8. **(currently amended)** A transmission bandwidth control device according to Claim 6, wherein the quality guaranteed route searching ~~means~~module selects such a route as to minimize a cross-over hop count in the network, and the quality non-guaranteed route searching ~~means~~module selects such a route as to minimize the network cross-over hop count.

9. **(currently amended)** A transmission bandwidth control device according to Claim 5, wherein the quality guaranteed route searching ~~means~~module selects such a route as to minimize a cross-over hop count in the network, and the quality non-guaranteed route

searching ~~means~~module selects such a route as to maximize a residual bandwidth in the network.

10. **(currently amended)** A transmission bandwidth control device according to Claim 6, wherein the quality guaranteed route searching ~~means~~module selects such a route as to minimize a cross-over hop count in the network, and the quality non-guaranteed route searching ~~means~~module selects such a route as to maximize a residual bandwidth in the network.

11. **(currently amended)** A transmission bandwidth control device according to Claim 5, wherein the quality guaranteed route searching ~~means~~module selects such a route as to maximize a residual bandwidth in the network, and the quality non-guaranteed route searching ~~means~~module selects such a route as to minimize the cross-over hop count in the network.

12. **(currently amended)** A transmission bandwidth control device according to Claim 6, wherein the quality guaranteed route searching ~~means~~module selects such a route as to maximize a residual bandwidth in the network, and the quality non-guaranteed route searching ~~means~~module selects such a route as to minimize the cross-over hop count in the network.

13. **(currently amended)** A transmission bandwidth control device according to Claim 5, wherein the quality guaranteed route searching ~~means~~module selects such a route as to maximize a residual bandwidth between a network ingress node and a network egress node in the network, and the quality non-guaranteed route searching ~~means~~module selects such a

route as to maximize a residual bandwidth between the network ingress node and the network egress node in the network.

14. **(currently amended)** A transmission bandwidth control device according to Claim 6, wherein the quality guaranteed route searching ~~means~~module selects such a route as to maximize a residual bandwidth between a network ingress node and a network egress node in the network, and the quality non-guaranteed route searching ~~means~~module selects such a route as to maximize a residual bandwidth between the network ingress node and the network egress node in the network.

15. **(currently amended)** A transmission bandwidth control device according to Claim 5, wherein the quality guaranteed route searching ~~means~~module selects such a route as to minimize a residual bandwidth between the network ingress node and the network egress node in the network, and the quality non-guaranteed route searching ~~means~~module selects such a route as to minimize a cross-over hop count between the network ingress node and the network egress node in the network.

16. **(currently amended)** A transmission bandwidth control device according to Claim 6, wherein the quality guaranteed route searching ~~means~~module selects such a route as to minimize a residual bandwidth between the network ingress node and the network egress node in the network, and the quality non-guaranteed route searching ~~means~~module selects such a route as to minimize a cross-over hop count between the network ingress node and the network egress node in the network.

17. **(currently amended)** A transmission bandwidth control device according to

Claim 5, wherein the quality guaranteed route searching ~~means~~module selects such a route as to minimize a residual bandwidth between the network ingress node and the network egress node in the network, and the quality non-guaranteed route searching ~~means~~module selects such a route as to maximize a residual bandwidth between the network ingress node and the network egress node in the network.

18. **(currently amended)** A transmission bandwidth control device according to

Claim 6, wherein the quality guaranteed route searching ~~means~~module selects such a route as to minimize a residual bandwidth between the network ingress node and the network egress node in the network, and the quality non-guaranteed route searching ~~means~~module selects such a route as to maximize a residual bandwidth between the network ingress node and the network egress node in the network.

19. **(currently amended)** A transmission bandwidth control device according to

Claim 7, wherein the quality guaranteed route searching ~~means~~module when there exist a plurality of such routes as to minimize the ~~cross-over~~-hop count between the network ingress node and the network egress node, selects such a route as to maximize a residual bandwidth therein between the network ingress node and the network egress node or such a route as to minimize a residual bandwidth therein between the network ingress node and the network egress node, and the quality non-guaranteed route searching ~~means~~module when there exist a plurality of such routes as to minimize the ~~cross-over~~-hop count between the network ingress node and the network egress node, selects such a route as to maximize a residual bandwidth therein between the network ingress node and the network egress node.

20. (currently amended) A transmission bandwidth control device according to

Claim 8, wherein the quality guaranteed route searching ~~means~~module when there exist a plurality of such routes as to minimize the cross-over hop count between the network ingress node and the network egress node, selects such a route as to maximize a residual bandwidth therein between the network ingress node and the network egress node or such a route as to minimize a residual bandwidth therein between the network ingress node and the network egress node, and the quality non-guaranteed route searching ~~means~~module when there exist a plurality of such routes as to minimize the cross-over hop count between the network ingress node and the network egress node, selects such a route as to maximize a residual bandwidth therein between the network ingress node and the network egress node.

21. (currently amended) A transmission bandwidth control device according to

Claim 9, wherein the quality guaranteed route searching ~~means~~module when there exist a plurality of such routes as to minimize the cross-over hop count between the network ingress node and the network egress node, selects such a route as to maximize a residual bandwidth therein between the network ingress node and the network egress node or such a route as to minimize a residual bandwidth therein between the network ingress node and the network egress node, and the quality non-guaranteed route searching ~~means~~module when there exist a plurality of such routes as to maximize the residual bandwidth between the network ingress node and the network egress node, selects such a route as to minimize a cross-over hop count therein between the network ingress node and the network egress node.

22. (currently amended) A transmission bandwidth control device according to

Claim 10, wherein the quality guaranteed route searching ~~means~~module when there exist a plurality of such routes as to minimize the cross-over hop count between the network ingress

node and the network egress node, selects such a route as to maximize a residual bandwidth therein between the network ingress node and the network egress node or such a route as to minimize a residual bandwidth therein between the network ingress node and the network egress node, and the quality non-guaranteed route searching ~~means~~module when there exist a plurality of such routes as to maximize the residual bandwidth between the network ingress node and the network egress node, selects such a route as to minimize a cross-over hop count between the network ingress node and the network egress node.

23. **(currently amended)** A transmission bandwidth control device according to claim 11, wherein the quality guaranteed route searching ~~means~~module when there exist a plurality of routes as to maximize the residual bandwidth between the network ingress node and the network egress node, selects such a route as to minimize a cross-over hop count therein between the network ingress node and the network egress node or such a route as to minimize a residual bandwidth therein between the network ingress node and the network egress node, and the quality non-guaranteed route searching ~~means~~module when there exist a plurality of such routes as to minimize the cross-over hop count between the network ingress node and the network egress node, selects such a route as to maximize a residual bandwidth therein between the network ingress node and the network egress node.

24. **(currently amended)** A transmission bandwidth control device according to claim 12, wherein the quality guaranteed route searching ~~means~~module when there exist a plurality of such routes as to maximize the residual bandwidth between the network ingress node and the network egress node, selects such a route as to minimize a cross-over hop count therein between the network ingress node and the network egress node or such a route as to minimize a residual bandwidth therein between the network ingress node and the network

egress node, and the quality non-guaranteed route searching ~~means~~module when there exist a plurality of such routes as to minimize the cross-over hop count between the network ingress node and the network egress node, selects such a route as to maximize a residual bandwidth therein between the network ingress node and the network egress node.

25. **(currently amended)** A transmission bandwidth control device according to Claim 13, wherein the quality guaranteed route searching ~~means~~module when there exist a plurality of such routes as to maximize the residual bandwidth between the network ingress node and the network egress node, selects such a route as to minimize a cross-over hop count between the network ingress node and the network egress node or such a route as to minimize a residual bandwidth therein between the network ingress node and the network egress node, and the quality non-guaranteed route searching ~~means~~module when there exist a plurality of such routes as to maximize the residual bandwidth therein between the network ingress node and the network egress node, selects such a route as to minimize a cross-over hop count between the network ingress node and the network egress node.

26. **(currently amended)** A transmission bandwidth control device according to Claim 14, wherein the quality guaranteed route searching ~~means~~module when there exist a plurality of such routes as to maximize the residual bandwidth between the network ingress node and the network egress node, selects such a route as to minimize a cross-over hop count between the network ingress node and the network egress node or such a route as to minimize a residual bandwidth therein between the network ingress node and the network egress node, and the quality non-guaranteed route searching ~~means~~module when there exist a plurality of such routes as to maximize the residual bandwidth between the network ingress node and the

network egress node, selects such a route as to minimize a cross-over hop count between the network ingress node and the network egress node.

27. **(currently amended)** A transmission bandwidth control device according to Claim 15, wherein the quality guaranteed route searching ~~means~~module when there exist a plurality of such routes as to minimize the residual bandwidth between the network ingress node and the network egress node, selects such a route as to maximize a residual bandwidth therein between the network ingress node and the network egress node or such a route as to minimize a cross-over hop count between the network ingress node and the network egress node, and the quality non-guaranteed route searching ~~means~~module when there exist a plurality of such routes as to minimize the cross-over hop count between the network ingress node and the network egress node, selects such a route as to maximize a residual bandwidth between the network ingress node and the network egress node.

28. **(currently amended)** A transmission bandwidth control device according to Claim 16, wherein the quality guaranteed route searching ~~means~~module when there exist a plurality of such routes as to minimize the residual bandwidth therein between the network ingress node and the network egress node, selects such a route as to maximize a residual bandwidth therein between the network ingress node and the network egress node or such a route as to minimize a cross-over hop count between the network ingress node and the network egress node, and the quality non-guaranteed route searching ~~means~~module when there exist a plurality of such routes as to minimize the cross-over hop count between the network ingress node and the network egress node, selects such a route as to maximize a residual bandwidth therein between the network ingress node and the network egress node.

29. **(currently amended)** A transmission bandwidth control device according to claim 17, wherein the quality guaranteed route searching ~~means~~module when there exist a plurality of such routes as to minimize the residual bandwidth between the network ingress node and the network egress node, selects such a route as to minimize a cross-over hop count therein between the network ingress node and the network egress node or such a route as to maximize a residual bandwidth therein between the network ingress node and the network egress node, and the quality non-guaranteed route searching ~~means~~module when there exist a plurality of such routes as to maximize the residual bandwidth between the network ingress node and the network egress node, selects such a route as to minimize a cross-over hop count between the network ingress node and the network egress node.

30. **(currently amended)** A transmission bandwidth control device according to claim 18, wherein the quality guaranteed route searching ~~means~~module when there exist a plurality of such routes as to minimize the residual bandwidth between the network ingress node and the network egress node, selects such a route as to minimize a cross-over hop count therein between the network ingress node and the network egress node or such a route as to maximize a residual bandwidth therein between the network ingress node and the network egress node, and the quality non-guaranteed route searching ~~means~~module when there exist a plurality of such routes as to maximize the residual bandwidth between the network ingress node and the network egress node, selects such a route as to minimize a cross-over hop count between the network ingress node and the network egress node.

31. **(currently amended)** A transmission bandwidth control device according to Claim 5, wherein at least one of the quality guaranteed route searching ~~means~~module and the

quality non-guaranteed route searching ~~means~~module, at a point of time when selecting a route afresh, switches over a route selection system.

32. **(currently amended)** A transmission bandwidth control device according to Claim 6, wherein at least one of the quality guaranteed route searching ~~means~~module and the quality non-guaranteed route searching ~~means~~module, at a point of time when selecting a route afresh, switches over a route selection system.

33. **(currently amended)** A transmission bandwidth control device according to Claim [[2]]1, wherein the quality non-guaranteed route searching ~~means~~module, when selecting a route for a flow that does not guarantee a forwarding quality, a ratio of a remaining bandwidth which is a result of subtracting a bandwidth for a flow that guarantees the forwarding quality and for the flow that does not guarantee the forwarding quality from the entire link as a link's physical bandwidth, with respect to the entire link bandwidth, is used as a link's available bandwidth.

34. **(currently amended)** A transmission bandwidth control device according to Claim [[2]]1, wherein the quality non-guaranteed route searching ~~means~~module, when selecting a route for a flow that does not guarantee a forwarding quality, a remaining bandwidth which is a result of subtracting a bandwidth for a flow that guarantees the forwarding quality and for the flow that does not guarantee the forwarding quality from the entire link as a link's physical bandwidth, is used as a link's available bandwidth.

35. **(currently amended)** A transmission bandwidth control device according to Claim [[2]]1, wherein the quality non-guaranteed route searching ~~means~~module, when

selecting a route for a flow that does not guarantee a forwarding quality, uses a ratio of a remaining bandwidth, as a link's residual bandwidth, which is a result of subtracting the bandwidth for the flow that does not guarantee the forwarding quality from a link bandwidth as link's physical bandwidth, with respect to a bandwidth unreserved for the flow that guarantees the forwarding quality.

36. **(currently amended)** A transmission bandwidth control device according to Claim [[2]]~~1~~, wherein the quality guaranteed route searching ~~means~~module, when selecting a route for a flow that guarantees a forwarding quality, uses a remaining bandwidth, as a link's residual bandwidth, which is a result of subtracting the bandwidth for the forwarding quality guaranteed flow from a bandwidth utilizable for the forwarding quality guaranteed flow.

37. **(currently amended)** A transmission bandwidth control device according to Claim [[2]]~~1~~, wherein the quality guaranteed route searching ~~means~~module, when selecting a route for a flow that guarantees a forwarding quality, uses a ratio of a remaining bandwidth, as a link's residual bandwidth, which is a result of subtracting a bandwidth for the forwarding quality guaranteed flow from a bandwidth utilizable for the forwarding quality guaranteed flow, with respect to the bandwidth utilizable for the forwarding quality guaranteed flow.

38. **(currently amended)** A transmission bandwidth control device according to Claim 34, wherein the quality non-guaranteed route searching ~~means~~module, when accepting a request for a service, determines a route from a topology taking allowances for the entire link.

39. **(currently amended)** A transmission bandwidth control device according to

Claim 36, wherein the quality guaranteed route searching ~~means~~module, when accepting a request for a service, determines a route from a topology taking allowances for only a link of which a link's residual bandwidth is equal to or larger than the request bandwidth.

40. **(currently amended)** A transmission bandwidth control device according to

Claim 5, wherein the quality guaranteed route searching ~~means~~module when accepting a request for a service that guarantees a forwarding quality, makes a selection from a topology connecting links of which a using bandwidth for a service that does not guarantee the forwarding quality does not exceed a threshold value and of which a residual bandwidth obtained by a calculation of a link's using bandwidth is equal to or larger than the request bandwidth.

41. (original) A transmission bandwidth control device according to Claim 5, further

comprising module referring to a threshold value related to a path using ratio, wherein the load sharing control unit, in the case of exceeding the threshold value related to the using ratio, shifts the flow that does not guarantee the forwarding quality to a detour route.

42. **(currently amended)** A transmission bandwidth control device according to

Claim 5, further comprising module referring to a threshold value related to a ratio at which an actual using bandwidth for a service that does not guarantee the forwarding quality occupies a bandwidth left by subtracting a bandwidth ensured for the service that guarantees the forwarding quality in a path, wherein the router control unit, when the ratio of the actual using bandwidth exceeds the threshold value, shifts the flow that does not guarantee the forwarding quality to a ~~an~~a detour route.

43. **(currently amended)** A transmission bandwidth control device according to Claim 5, wherein the quality non-guaranteed route searching ~~means~~module further includes module referring to a threshold value related to a ratio at which an estimated range of the using bandwidth for the service that does not guarantee the forwarding quality occupies a bandwidth left by subtracting a bandwidth ensured for such a service as to guarantee the forwarding quality in the path by accepting the estimated range of the using bandwidth when accepting a request for the service that does not guarantee the forwarding quality, and the router control unit, when the ratio exceeds the threshold value, shifts the flow that does not guarantee the forwarding quality to the detour route.

44. **(currently amended)** A transmission bandwidth control device according to Claim 6, wherein at least one of the quality guaranteed route searching ~~means~~module and the quality non-guaranteed route searching ~~means~~module, when accepting a request for a service that guarantees a forwarding quality and a request for a service that does not guarantee the forwarding quality, selects a route in accordance with an individually predetermined route selection policy, and, when accepting the request for the service that guarantees the forwarding quality, determines a route from a topology taking allowances for a link of which a link's residual bandwidth is equal to or larger than the request bandwidth and for a link where a ratio at which a quality non-guaranteed traffic occupies the link does not exceed a predetermined reference value.

45. **(currently amended)** A transmission bandwidth control device according to Claim 6, wherein the quality guaranteed route searching ~~means~~module when accepting a request for a service that guarantees a forwarding quality selects a route from a topology

connecting links of which a using bandwidth for a service that does not guarantee the forwarding quality does not exceed a set threshold value and of which a residual bandwidth obtained by a calculation of the link's using bandwidth is equal to or larger than the request bandwidth.

46. **(currently amended)** A transmission bandwidth control device according to Claim 6, wherein the load sharing control unit further includes module referring to a threshold value related to the path using ratio as a ratio of the used bandwidth among the entire bandwidth of the path, and, when the path using ratio is less than the threshold value, the router control unit, when there is a residual bandwidth for accommodating the quality guaranteed flow and there exists other less optimal path, shifts the quality guaranteed flow to the path of which the using ratio is less than the threshold value from the less optimal path.

47. **(currently amended)** A transmission bandwidth control device according to Claim 6, wherein the load sharing control unit further includes module referring to a threshold value related to a bandwidth ensured for the service that guarantees the forwarding quality in the path, and, when the using-ratio-bandwidth ensured for the service is less than the threshold value, the router control unit, when there is a residual bandwidth for accommodating the quality guaranteed flow and there exists other less optimal path, shifts the quality guaranteed flow to an optimal path having the residual bandwidth.

48. **(currently amended)** A transmission bandwidth control device according to Claim 6, wherein the load sharing control unit further includes module referring to a threshold value related to a ratio at which a bandwidth ensured for the service that guarantees the forwarding quality occupies a bandwidth utilizable for the quality guaranteed service in

the path, and, when the ratio is less than the threshold value, the router control unit, when there is a residual bandwidth for accommodating the quality guaranteed flow and there exists other less optimal path, shifts the quality guaranteed flow to an optimal path having the residual bandwidth.

49. **(currently amended)** A transmission bandwidth control device according to Claim 6, wherein the load sharing control unit further includes module referring to a threshold value related to an actual using bandwidth as an actually used bandwidth among guaranteed bandwidth for the service that guarantees the forwarding quality in the path, and, when the actual using bandwidth is less than the threshold value, the router control unit, when there is a residual bandwidth for accommodating the quality guaranteed flow and there exists other less optimal path, shifts the quality guaranteed flow to an optimal path having the residual bandwidth.

50. **(currently amended)** A transmission bandwidth control device according to Claim 6, wherein the load sharing control unit further includes module referring to a threshold value related to a ratio at which ~~an actual using~~ an actually used bandwidth for the service that guarantees the forwarding quality occupies a bandwidth utilizable for the quality guaranteed service in the path, and, when the ratio is less than the threshold value, the router control unit, when there is a residual bandwidth for accommodating the quality guaranteed flow and there exists other less optimal path, shifts the quality guaranteed flow to an optimal path having the residual bandwidth.

51. (original) A transmission bandwidth control device according to Claim 6, wherein the load sharing control unit, in a state where a plurality of paths are set up for the flow that

guarantees the forwarding quality, in the case of being unable to ensure a request bandwidth for the quality guaranteed service due to a small residual bandwidth but in the case of being able to ensure the request bandwidth by shifting the existing flows accommodated in the plurality of paths, accepts a request by effecting a flow shift.

52. **(currently amended)** A transmission control method of controlling a transmission route for a flow in a network, comprising:

collecting pieces of statistical information from respective routers connected to the network;

accepting a flow forwarding request from a user terminal;

quality-guaranteed-route searching for quality guaranteed route information corresponding to the request for ~~the~~ forwarding the flow that guarantees a forwarding quality by referring to the network statistical information and the request from the user terminal;

quality-non-guaranteed-route searching for a quality non-guaranteed route corresponding to the request for forwarding the flow that does not guarantee the forwarding quality by referring to the network statistical information and the request from the user terminal;

executing such a load sharing process as to generate router setting information for sharing a transmission load of the network by referring to at least one of the network statistical information the quality guaranteed route information and quality non-guaranteed route information; and

setting a router based on ~~the route information~~, the router setting information, the quality guaranteed route information and the quality non-guaranteed route information.

53. (currently amended) A transmission bandwidth control device according to

Claim [[2]]1, further comprising a congestion judging unit for judging by referring to the link statistical information whether a load state of the path falls into a congestion or not, wherein when the load state of the path falls into the congestion, the quality non-guaranteed route searching ~~means~~module searches for quality non-guaranteed route information, the load sharing control unit executes the load sharing process by referring to the quality guaranteed route information and the quality non-guaranteed route information, and the router control unit sets a quality non-guaranteed route in accordance with the quality non-guaranteed route information.